

**L2(5.2) - Translations of a Quadratic Relation**

1. factored form:  $y = a(x - s)(x - t)$

2. standard form:  $y = ax^2 + bx + c$

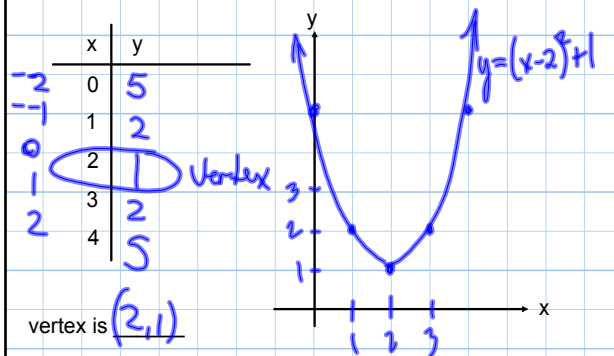
3. vertex form:  $y = a(x - h)^2 + k$

$a$  tells us the **direction of opening** (up or down),  
and any **vertical scaling** (stretch or compression)

$h$  is the **x-coordinate** of the vertex.

$k$  is the **y-coordinate** of the vertex.

Ex.1 Graph  $y = (x - 2)^2 + 1$  using a TOV.



The vertex of the parent function,  $\star y = x^2$ , is  $(0, 0)$ .

If the vertex has moved from  $(0, 0)$  to  $(h, k)$  then the graph has been

translated  $\star$  **vertically by  $k$  units** (up or down)

and  $\star$  **horizontally by  $h$  units** (left or right)

Vertex Form:  $y = a(x - h)^2 + k$

What about the signs of  $h$  and  $k$ ?

-  $k$  stays the same  
-  $h$  opposite from the equation

Ex.2 State the coordinates of the vertex and direction of opening.

(a)  $y = (x - 5)^2 + 4$  Vertex  $(5, 4)$  Opens **Up**

(b)  $y = (x + 3)^2 + 11$  Vertex  $(-3, 11)$  Opens **Up**

(c)  $y = -2(x - 6)^2 - 8$  Vertex  $(6, -8)$  Opens **Down**

(d)  $y = \frac{3}{4}(x + 13)^2 - 2$  Vertex  $(-13, -2)$  Opens **Up**

(e)  $y = -(x - 4)^2 + 5$  Vertex  $(4, 5)$  Opens **Down**

Ex. 3. Identify the transformations (in the correct order), the vertex, axis of symmetry, and the direction of opening.

a)  $y = (x - 2)^2 - 3$

- horizontal shift right by 2 units
- vertical shift down by 3 units

Vertex  $(2, -3)$  AOS:  $x = 2$

Direction of opening: Up optimal value: -3

b)  $y = 2(x + 4)^2$

$2(x+4)(x+4)$

Transformations

- ① Vertical stretch by a factor of 2
- ② Horizontal shift left by 4 units

Vertex  $(-4, 0)$  AOS:  $x = -4$

Direction of opening = Up  
Optimal value = 0

c)  $y = -0.5x^2 + 4$

Standard & vertex

$-0.5(x-0)^2 + 4$

across

Vertex  
 $(0, 4)$

AOS  
 $x = 0$

transformations

- ① reflection in the x-axis
- ② Vertical compression by a factor of 0.5
- ③ Vertical shift up by 4 units

Direction of opening = down.

optimal value  
4

Assigned Work:

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